DEPARTMENT OF THE INTERIOR, CANADA

HON. T. A. CRERAR, Minister J. M. WARDLE, Deputy Minister

GEODETIC SURVEY OF CANADA

NOEL J. OGILVIE, Director

ANNUAL REPORT

OF THE DIRECTOR

OF THE

GEODETIC SURVEY OF CANADA

FOR THE

FISCAL YEAR ENDING MARCH 31, 1936

OTTAWA
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
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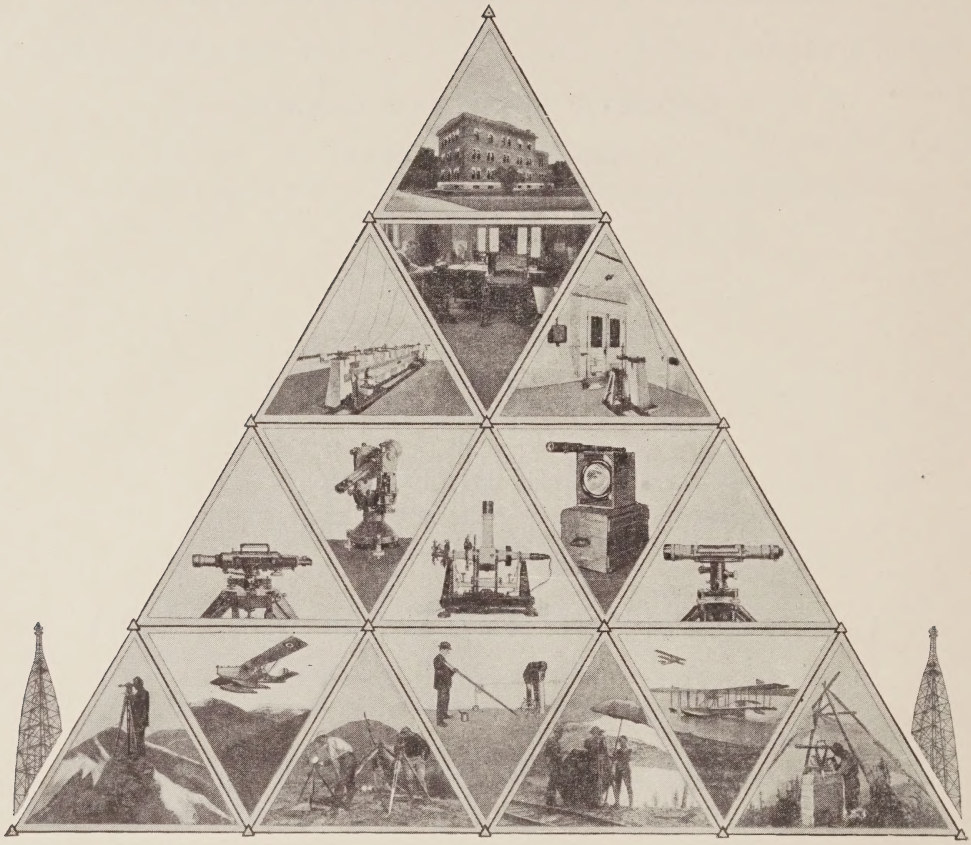


OPERATIONS OF THE GEODETIC SURVEY OF CANADA

Top—Geodetic Survey Building at Ottawa.

Second row, left to right—

North end of Standards building, showing five-meter bar apparatus.
Office of Precise Level Adjusting Division.
Fiducial point at south end of 50-metre comparator, in Standards building.

Third row, left to right—

Precise Level, U.S.C. & G.S. Pattern.
Latest Model Primary Triangulation Model theodolite.
Latest Model Astronomical Transit.
Electric Signal Lamp for Primary Triangulation.
Precise Level, Zeiss Model.

Bottom row, left to right—

Observing on Secondary Triangulation.
Photographic and Transport Hydroplane, Canadian model.
Sending instructions to light keepers by heliograph.
Setting rear end of tape in Baseline measurement.
Observing Precise Levels in the Yukon Territory.
A Transport Hydroplane at rest.
Observing Primary Triangulation.

On flanks—

Triangulation Tower near Chatham, Ont., with Lamp-stand extended 37 feet. Height of Lamp-stand: 147 feet.

THE GEODETIC SURVEY OF CANADA

ANNUAL REPORT OF THE DIRECTOR, NOEL J. OGILVIE

INTRODUCTION

The operations of the Geodetic Survey of Canada, Department of the Interior, comprise primary triangulation, precise levelling, geodetic astronomy, triangulation base line measurement, geodetic research, triangulation adjustment, precise levelling adjustment, isostasy, and the publication of geodetic information.

Field operations were carried on in the provinces of Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, and British Columbia.

Important links of primary and secondary triangulation were completed.

Following an arrangement between the Government of Canada and the Commission of Government of Newfoundland, the Geodetic Survey of Canada undertook certain geodetic operations in the latter country. Satisfactory progress in this work is reported.

Precise levelling was carried on. Standard bench marks were established. Water levels of lakes and rivers were determined. The inspection of bench marks was continued; also the work of redescribing certain bench marks. Elevation plates were attached to certain fundamental bench marks.

In accordance with the Order in Council of March 11, 1935, the elevations of works or projects of the Government of the Dominion of Canada are being referred to Canadian Geodetic datum, namely mean sea-level as determined at coastal points by the Canadian Hydrographic Service and carried inland by the Canadian Geodetic Service.

The longitude and latitude of certain points in Canada were determined by star observations. Base line measurement equipment was standardized. Computations in Isostasy were continued.

The adjustment and preparation for publication of primary triangulation results was carried on.

The adjustment of precise levels was proceeded with.

The work of transferring geographical co-ordinates from the Clarke spheroid to the International ellipsoid, as recommended by the International Union of Geodesy and Geophysics, was continued.

Material for Canada's contribution to the Reports of the International Association of Geodesy was prepared for the Sixth General Conference of the International Geodetic and Geophysical Union, to be held in September 1936, at Edinburgh.

Requests for geodetic control data were received as in previous years from Dominion and Provincial Government departments, municipalities and the engineering and surveying public. The most recently determined data were promptly supplied.

The maps inside the back cover of this report show the condition of field operations at the end of the year 1935.

A number of publications of the Geodetic Survey of Canada were printed and distributed. The preparation of manuscripts has been carried on. Notification and acknowledgment cards, and correspondence, were employed in the distribution of publications and in the revision of the mailing list of the Geodetic Survey of Canada.

Triangulation

Field work was carried out in four areas during 1935. Primary triangulation was continued on the net through central British Columbia, a local secondary net was laid down covering Fort William harbour for the control of a survey of the harbour line, a detached secondary net was laid down in the Lac Seul district of northern Ontario and a start was made on the Geodetic Survey of Newfoundland, for which the technical officers were supplied by the Geodetic Survey of Canada.

Below is a tabular statement of the triangulation operations carried out during the season of 1935:—

TABLE 1—TRIANGULATION OPERATIONS

Field operations	Miles
Completed primary triangulation; axial length	125
Completed secondary triangulation; axial length	70
Primary reconnaissance, observing not yet started; axial length	805
Precise traverse, length	....

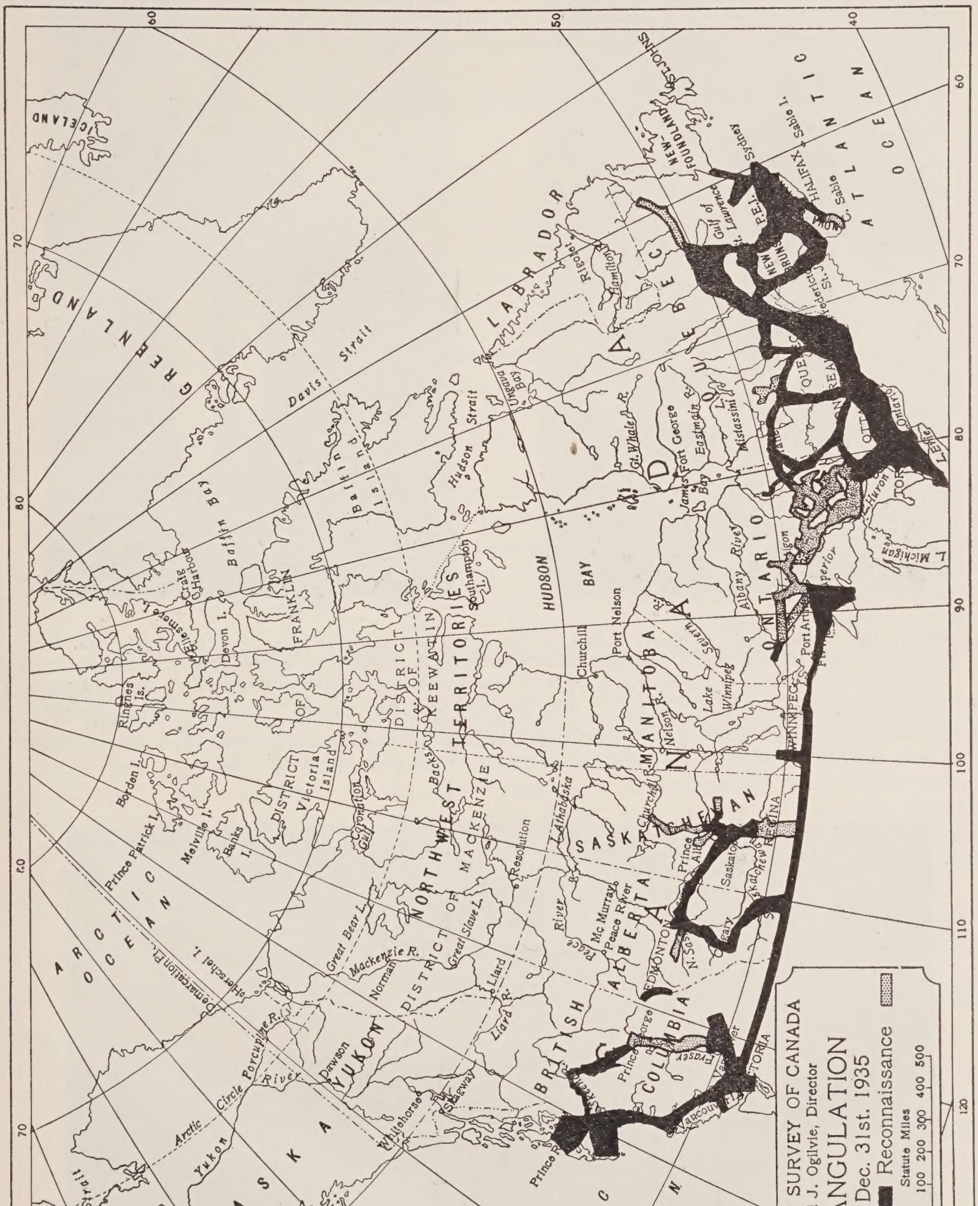
To date 7,677 miles of primary triangulation, 1,121 miles of secondary triangulation, and 503 miles of precise traverse have been completed.

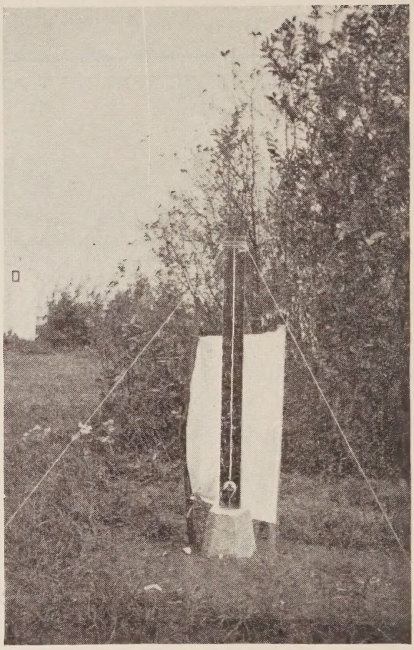
Aerial Reconnaissance Statistics.—Combining the records of 1935 aerial reconnaissance in Newfoundland and former operations, the following table has been compiled. The flying times on which these figures were based do not include the time going to and returning from the area to be covered, but they do include time moving from base to base and time flying to and from work from day to day.

TABLE 2—AERIAL RECONNAISSANCE DATA

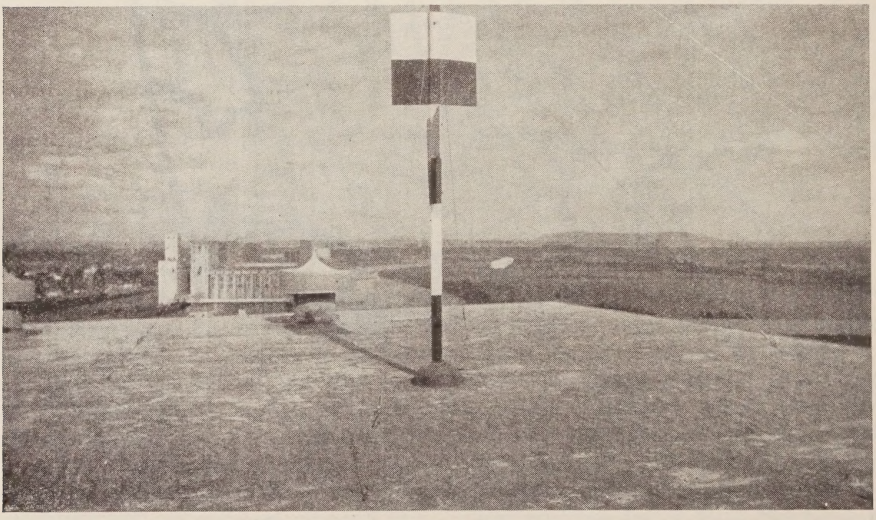
Operation	Area covered per flying hour	Axial distance along net per flying hour	Stations selected per flying hour
	sq. miles	miles	number
Northern Ontario, winter 1931	223	11	1·7
Northern Saskatchewan, April 1931	218	12	1·2
Northern Ontario, September 1931	354	11·5	1·4
Northern Ontario, winter 1935	179	9·9	1·5
Newfoundland, 1935	177	7·2	1·1

In estimating the flying time for the aerial reconnaissance of any proposed triangulation net the figures of 200 square miles or 10 miles of axial length per flying hour are employed. To this is added the flying time going to and returning from the area. These figures apply to topographic conditions which give stations at about 20-mile intervals, with hills reasonably prominent and for planes which have a gasolene capacity for five or six flying hours. Where lines are shorter than 20 miles and hills found with difficulty, the area and axial length covered per flying hour are correspondingly low. The progress varies with the amount of clear visibility (not necessarily with the amount of sunlight); in Canada the average progress is about 100 miles per week per aeroplane. Two planes are usually employed, and bases are selected about 150 to 200 miles apart with planes having a fuel capacity for five flying hours.


GEODETIC SURVEY OF CANADA
Noel J. Ogilvie, Director
TRIANGULATION
To Dec. 31st. 1935
Observed
Reconnaissance
Statute Miles
100 0 100 200 300 400 500



Left.—Two snow covered signal lamps at triangulation station Roy on a mountain top in central British Columbia in August, 1935. At stations difficult of access lightkeepers are in constant attendance during hours of observation to assure that no circumstance such as the above will prevent lights being seen by the observers at distant stations. *Right.*—Signal employed on quarter- to half-mile lines in the triangulation of Fort William harbour. It consists of a black mason's plumb-rule with a quarter-inch white strip down the centre. The white flag behind the signal permits easy sighting on the signal.



Triangulation monument and signal on the concrete roof of a grain elevator in the Fort William Harbour triangulation net. Phase was practically eliminated with this type of signal as evidenced by the low average misclosure of triangles (1″·15). This type of signal was employed on lines one-half to nine miles in length.

Triangulation in Central British Columbia

Two operations were planned in central British Columbia for the season of 1935. One was the angular measurements in the area roughly adjoining the main line of the Canadian Pacific Railway from North Bend, 125 miles northeast of Vancouver, through Ashcroft, Kamloops, and Salmon Arm to Sicamous, an axial distance of 125 miles; the other was the completion of the reconnaissance along the Caribou highway to fill the small gap between Ashcroft and Quesnel.

Results Obtained.—Reconnaissance: 8 primary stations selected; axial length 70 miles. Angular measurements: 12 new primary stations occupied, 2 primary stations occupied which had been previously partly completed; 12 supplementary and tertiary stations located; axial length of net, 125 miles; area within triangulation lines, 6,400 square miles.

In 1930 the triangulation party working in the above area had completed the angular measurements—except for a small amount of remeasurement—up the Fraser river to a point about 125 miles northeast of Vancouver, and had selected and prepared for observing the required stations as far as the Salmon Arm base net. Operations had been discountinued after 1930, and in 1935 it was planned to do the observing in the area prepared in 1930 and finish the reconnaissance as far north as Quesnel.

As the lightkeepers were all new to their duties and had no previous experience in mountain work, it was decided to commence at the Salmon Arm base net, where it would be possible to gradually break in the party to climbing and to give an opportunity of training the men in visual signalling and the correct use of signal lamps. Due to the generally rugged nature of the country and the difficulty of reaching many of the stations, lightkeepers were utilized at the more inaccessible points, while time switches were used to operate the signal lamps at those easily reached.

The party started work on May 7, at the Salmon Arm base (measured in 1912 by the Topographical Surveys Branch in connection with a triangulation of the Railway Belt), and erected two small towers to clear buildings erected since the base was first measured. Angular measurements were then commenced. Great difficulty and considerable delay was caused by the late season and the depth of snow on the mountains. Lightkeepers and observers camped at the stations rather than below the snow line. On some of the higher summits snowstorms were encountered in all months of the season.

In July the party was enlarged to a double observing party and the reconnaissance northward along the Cariboo road was practically completed, five primary and a number of secondary stations being selected.

Due to bad weather, operations were discontinued for the season about September 20.

Triangulation of Fort William Harbour

At the request, and at the expense, of the Department of Public Works a triangulation system was laid down in 1935 covering the harbour of Fort William, Ontario, which occupies the banks of the lower Kaministikwia, the McKellar, and the Mission rivers. The latter two rivers are diverging mouths of the Kaministikwia, where it flows through its delta into Thunder bay.

The purpose of the scheme was to provide a series of permanently marked, accurately positioned points to check and control detailed surveys for defining the 25-mile harbour line and which could be employed to ascertain readily the position of any part of the harbour line at any later date.

On three sides of the harbour are commanding elevations on which five main triangulation stations were placed. Three main stations were placed on the concrete roofs of grain elevators and one near the level of lake Superior. At

intervals of from 4,000 to 7,000 feet along the banks of the three rivers 19 subsidiary stations were placed to control the detailed surveys of the harbour line itself.

A base line was laid out, but it will not be measured until 1936. In the meantime the lengths of the lines are derived from a previous triangulation system in the neighbourhood.

Great attention was given to the permanent marking of stations. Those on solid rock were marked by bronze triangulation station tablets referenced by at least two bronze reference mark tablets; in earth, which was the general rule, substantial concrete monuments in two sections—surface and subsurface—from five to six feet deep were erected.

A net of high class secondary precision was desired. In line with this desire daylight observations on signals were employed. A primary triangulation theodolite on its own tripod was employed for the angular measurements, readings being taken on eight positions of the circle for main stations and on four circle positions for intersection stations. Daylight signals were employed. As a criterion of the precision secured, the average misclosure of forty triangles was 1·15 seconds of arc, quite a satisfactory result in view of the shortness of the lines, which averaged three miles.

One main station, Chalet, situated half way up the face of mount McKay, is visible from the ground at practically all control stations in the net. As a result it acts as a common azimuth station and facilitates azimuth checks at control stations for the harbour line traverses. The small area and large number of stations made a heavy observing program, 30 lines radiating from one station.

SECONDARY TRIANGULATION, LAC SEUL, ONTARIO

This operation was a detached piece of secondary triangulation with its own base line, and its geographic position was provided by an astronomic position and azimuth. Lac Seul impounds waters for water plants serving mining areas and also acts as a storage reservoir for power plants on the Winnipeg river. Various surveys had already been made or were proposed in this area, and a secondary triangulation net was desired to serve as an accurate basis for these surveys. Apart from the main triangulation, it was desired that a number of control points of previous surveys be tied in.

While the Lac Seul net is at present detached from main triangulation nets in northern Ontario an aerial reconnaissance had already been made to locate the primary net in that area. When this is completed the Lac Seul net will fit on to the primary nets.

Results Obtained.—Eighteen main stations and five supplementary stations selected and observed. Towers built at all main stations of an average height of 41 feet. Axial length of net, 60 miles. Area covered, 450 square miles. One base line selected and measured. One astronomical station occupied.

In the Lac Seul area, particularly on the north side of the lake, there are few isolated hills. The ridges are heavily wooded and mostly of about the same height. This condition extends and intensifies westerly to the prairies in Manitoba, and results in short lines from 5 to 15 miles in length.

The net begins at the railway track at Hudson, Ontario—where a base line was measured along the railway right of way—continues northward to the main lake and then westward to Shanty Narrows, 18 miles east of the westerly end of the lake.

As the triangulation was intended to be of a second order of precision, daylight signals were used throughout, and the observation program included readings in eight positions of the horizontal circle. Special care was taken, however, in the design of the targets, and observations were taken only during the late afternoon when atmospheric conditions were best. As a result of these

precautions the average triangle misclosure was 0·93″ so that, on this basis, the precision of the net is primary rather than secondary. The inclusion of base and Laplace checks would be a final criterion of its precision.

The party was comprised of eleven men; two on reconnaissance, six on station preparation and tower building, two on angular measurements, and one cook.

TRIANGULATION OF NEWFOUNDLAND

At the request of the Commission of Government of Newfoundland, the Government of Canada agreed in March, 1935, to assist in the basic work of a Geodetic Survey of Newfoundland. Because of Canada's interest in the solution of problems respecting the gulf of St. Lawrence, an important shipping route, Canada agreed to furnish the technical officers for the operation, to supply the instrumental equipment and to calculate and publish the mathematical results. Newfoundland agreed to pay the field costs over an estimated period of five years.

It was agreed that the triangulation should consist of a primary net, roughly 350 miles in length, along the west coast of Newfoundland from cape Ray to the strait of Belle Isle, together with a secondary net, also about 350 miles long, adjacent to the Newfoundland railway, from the primary net eastward to St. John's.

The first season's operations consisted mainly of reconnaissance for the selection of stations and the preparation of these stations for making angular measurements. Ground reconnaissance methods were used for the 60-mile section northward from cape Ray. On all of the rest of the scheme aerial reconnaissance with two Newfoundland planes was the method employed for the selection of stations. Ground checking of the aerial reconnaissance, together with preparation of stations on the 125-mile section from cape Ray to bay of Islands was completed ready for the angular measurements in 1936. A base line was selected at St. Fintans near the southerly end and partly cleared for measurement in 1936.

In addition to the triangulation operations noted above three astronomical positions were observed for control of local detailed surveys, and tide gauges were installed by the Canadian Hydrographic Service at Port aux Basques and St. John's, the termini of the Newfoundland railway, to supply values of mean sea level for probable precise levels along the railway.

Results Obtained.—Ground Reconnaissance: 16 stations selected on an axial length of 60 miles. Aerial Reconnaissance: 107 stations selected on an axial length of 675 miles. Station Preparation: 25 stations prepared on an axial length of 125 miles. One Base Line selected and partially prepared for measurement. Three Astronomic Stations observed. Two Tide Gauges installed and readings carried on.

Levelling Division

FIELD OPERATIONS

Precise levelling was carried out in two provinces in the year 1935—Manitoba and Ontario—one party being engaged in the former province and two in the latter. No secondary levelling was done.

LEVELLING IN THE PROVINCE OF MANITOBA

Lines of the Canadian National Railway on the east and west sides of lake Manitoba were utilized to give levelling control in this area, levels being run from Winnipeg to Steep Rock and Gypsumville and from Portage la Prairie to Alonsa. A thirty-mile branch was run along travelled roads and across country from Mulvihill, on the Winnipeg-Gypsumville line to Siglunes, on the east shore

of lake Manitoba and a fifteen-mile extension from Alonsa to Kinosota, on the west shore of the lake opposite Siglunes. In the month of December, after the ice had formed, the Manitoba Department of Mines and Natural Resources made a precise level connection across the narrows of the lake between Kinosota and Siglunes, a distance of 5½ miles, thereby completing a circuit of precise levelling.

In the course of the Winnipeg-Gypsumville line 88 permanent bench marks of the Manitoba Department of Public Works were tied in and placed on the Canadian Geodetic datum, while at Steep Rock the bench mark and gauge of the Dominion Water Power and Hydrometric Bureau were connected.

During the course of the season's operations 97 standard bench marks were established.

LEVELLING IN THE PROVINCE OF ONTARIO

Precise levelling operations in Ontario were carried out in the area which lies northeast of lake Superior and east of lake Nipigon, the lines of the Canadian National Railway being used to break up the unduly large circuits of levelling already in existence. Two parties were in the field, levels being run from Nipigon to Longlac and Nakina, and from Longlac southeasterly through Hornepayne and Foleyet. At the end of the season levelling was discontinued near Tionaga, some 25 miles southeast of Foleyet. Bench marks established numbered 177 and in addition the water levels of many lakes and rivers were determined.

INSPECTION OF BENCH MARKS

The work of inspecting and redescribing bench marks taken over from the levelling system of the Department of Public Works was continued during 1935. All bench marks in the Province of Nova Scotia and those in New Brunswick east of Moncton were inspected.

The isolated line of levels run by the Department of Public Works from Stephen, (Minnesota) to Emerson, Winnipeg, and Winnipeg Beach, (Manitoba) was also covered, this latter inspection being combined with the work of attaching bronze plates to the fundamental bench marks at thirteen centres in Manitoba and northwestern Ontario. These plates, previously engraved, show the exact elevation of the fundamental bench marks above mean sea level. During the course of the Nova Scotia inspection also, elevation plates were attached to fourteen fundamental bench marks in that province.

SUMMARY

The following is a detailed statement of the precise levelling run in 1935:—

TABLE 3—PRECISE LEVELLING IN 1935

	Miles
Winnipeg to Steep Rock and Gypsumville	167·0
Mulvihill to Siglunes	29·7
Portage la Prairie to Kinosota	87·7
Nipigon to Nakina	161·4
Longlac to Tionaga	273·9
	719·7

Of the 720 miles levelled 672 were on Canadian National Railway lines and 48 on roads or cross-country routes.


GEODETIC SURVEY OF CANADA
Noel J. Ogilvie, Director
PRECISE LEVELLING
To Dec. 31st. 1935
Statute Miles
100 0 100 200 300 400 500

TABLE 4—LEVELLING TO DATE

—	Miles	Bench marks
Precise Levelling—		
Prior to 1935	24,725	8,686
1935	720	274
Total	25,445	8,960
Secondary Levelling—		
Prior to 1935	11,454	3,980
1935	0	0
Total	11,454	3,980

The total mileage of levelling, subdivided by provinces, at the end of the year 1935, was as follows:—

TABLE 5—LEVELLING BY PROVINCES

—	Precise	Secondary
Nova Scotia	729	0
New Brunswick	1,096	0
Quebec	3,418	640
Ontario	6,432	1,324
Manitoba	2,548	368
Saskatchewan	4,113	5,098
Alberta	2,866	3,799
British Columbia	3,690	225
Yukon Territory	458	0
State of Minnesota (U.S.A.)	89	0
State of Vermont (U.S.A.)	6	0
	25,445	11,454

LEVELLING PUBLICATIONS

During the year Publication No. 41-F, "Altitudes dans Québec au Sud du St. Laurent," containing 110 pages and giving 5,000 altitudes, and Publication No. 42-F, "Altitudes dans Québec au Nord du St. Laurent," containing 126 pages and 6,000 altitudes, were printed and distributed. The compilation of manuscript "Altitudes in Ontario," the largest of the series comprising the third revision of Altitudes in Canada, was actively continued and is expected to be completed during the coming year. Considerable work has been carried out during the year on the manuscript "Bench Marks in Ontario," in which will appear the results of the secondary levelling of the Geodetic Survey of Canada and also the geodetic levelling of the Department of Public Works, which has now been incorporated in the levelling system of this Survey.

Division of Geodetic Astronomy and Isostasy

Geodetic Astronomy.—During the year 1935-36 the field work of this division consisted of the following: one Laplace observation (longitude, latitude and azimuth) at a station in the Lac Seul triangulation in northwestern Ontario, latitude and longitude observations at one station of the geodetic triangulation in the Gaspe net, and at nine stations in Nova Scotia nets; latitude and longitude observations at three stations in Newfoundland; and longitude and latitude observations at eleven points of call of the Dominion Government's annual expedition to the shores of Hudson Bay and to the islands of Northern Canada.

The Laplace observation was made at the geodetic triangulation station, Grassy, just north of the town of Hudson on the Canadian National railway, and was for the purpose of supplying a datum for the geodetic triangulation in the Lac Seul district.

The observations in Quebec and Nova Scotia were to determine the deflections of the plumb line at those stations to be used in the study of Isostasy. The following stations were observed during 1935: Ste. Florence in Quebec, and Pugwash, Cape George, Cheticamp Roman Catholic Church, Crowdis, Balaam Head, Blue Mountain, Greenhill, Barr, and Gold in Nova Scotia.

In order to complete this important investigation in that part of Canada east of the Ontario-Quebec boundary line several more stations will be observed for longitude and latitude.

The three observations for longitude and latitude in Newfoundland were to supply data for the topographic work being carried on by the Commission of Natural Resources of Newfoundland. The stations observed were St. John's, Sops Arm on the northeast coast, and St. Lawrence on the south coast. It is of interest to know that the observations at St. John's were made on the site of observations for latitude and longitude made in the year 1828. The longitude was then determined from Halifax by the chronometric method, and the time was probably obtained from sextant observations. The results of 1828 compared with the precise determinations made in 1935 show a difference of 10 seconds of arc in latitude and about 15 seconds of time in longitude.

The eleven geographical points determined along the route of the steamer carrying the Dominion Government's annual Arctic expedition were Port Burwell at the eastern entrance to Hudson strait; Wakeham Bay and Sugluk on the south side of Hudson strait; Cape Wolstenholme at the west end of the strait; Cape Smith on Smith island off the east shore of Hudson bay; Port Harrison on the east coast of Hudson bay; Chesterfield at the entrance to Chesterfield inlet; Coral Harbour at the northeast end of South bay; Southampton island; Craig Harbour on the south coast of Ellesmere island; Clyde River on the east coast of Baffin island, and Pangnirtung on Cumberland sound, Baffin island. The results of these observations have been to change the geographical positions of these points as shown on existing maps by large amounts, in some cases, several miles. Plans are now under way for the continuation of this geographical work in these districts of Northern Canada.

Base Lines and Standards.—One base line near Hudson, Ontario, on the Canadian National railway, was measured during the past summer, and the invar base line tapes were standardized before and after measuring this base. This base line was to furnish a length datum for the Lac Seul triangulation net.

Isostasy.—The information necessary for a detailed study of the isostatic condition prevailing in Eastern Canada is being gradually accumulated, but there are yet required a large number of observations at points in the Maritime Provinces and Quebec before any definite results can be reached.

Division of Geodetic Research

During the year, the study of the problem of transferring geographical coordinates from the Clarke spheroid to the International ellipsoid was continued. The latter has been recommended by the International Union of Geodesy and Geophysics as the ellipsoid of universal reference. With regard to a solution of this problem, progress has been made.

Publication No. 54, in which is explained a new method of dealing with long geodetic lines, has been received from the printer and is being distributed. It is realized that extremely long lines are not of frequent occurrence in geodetic work, yet the principles employed in this new method should be applicable to the solution of many geodetic problems.

Division of Triangulation Adjustments

The work of this division during the last year has been confined largely to a continuation of the publication program outlined in the previous report.

The main triangulation system at present consists of three detached units. Results for that portion of the eastern unit extending from lake Huron easterly through Ontario and Quebec, covering the more settled areas of each province, and then southerly and easterly throughout New Brunswick, Prince Edward Island and Nova Scotia, with an extension to the southwest coast of Newfoundland, have been issued in eight publications of this survey.

There is at present in the hands of the printer a report covering the areas of Georgian bay and that easterly through Sudbury and North Bay to Mattawa; also the area of the Ottawa river valley from Ottawa westerly to lake Timiskaming, then northerly to Cochrane and easterly to Senneterre. These nets form the first tier of triangulation northerly of that along or near the International Boundary, and by reason of the small loop closure have had only the Georgian Bay section altered to absorb the closure. The work eastward from Senneterre to the St. Lawrence river, forming two loop closures, is now being prepared in manuscript form.

When the study of the geoid form for the Maritime Provinces was undertaken a number of years ago, it was felt that considerable extra data would be available shortly. This unfortunately has failed of fruition, but the relatively small amount of extra astronomic values at geodetic stations have so far corroborated the rise of the geoid towards the gulf of St. Lawrence. Contours for an isostatic geoid have been drawn for the section of Canada east of the 98th meridian.

As in other years, requests from other Government bureaus, engineering corporations and private individuals have been received and the required information has been compiled and forwarded. These requests are a reflection of the increasing use of geodetic work as control in other survey operations.

Division of Levelling Adjustments

During the fiscal year 1935-36 four lines, levelled during the summer season, were adjusted to the published elevations of existing bench marks. Two of these—172 and 173—were in Manitoba, one from Winnipeg to Gypsumville and the other from Portage la Prairie to Kinosota; the other two—174 and 175—were in northern Ontario, one from Nipigon to Nakina and the other from Longlac carried some miles beyond Oba on the line to Sudbury.

Further work was done on the combined level net of Canada and the United States, first, leaving out the tidal stations Old Point Comfort, Annapolis and Baltimore, and secondly including them. The result of the first of these adjustments shows a closer approximation to the elevations of the Canadian net, but there is evidence that further discrepancies are existent due to the effect of Atlantic City and Fort Hamilton. Further work is being done on this subject of mean sea level.

Publications of the Geodetic Survey of Canada, 1935-36

The following publications of the Geodetic Survey of Canada were printed: No. 41-F—" Altitudes dans Quebec au Sud du St. Laurent "; No. 42-F—" Altitudes dans Quebec au Nord du St. Laurent "; No. 60—" Triangulation in Ontario and Quebec "; Annual Report of the Director of the Geodetic Survey of Canada for the fiscal year ending March 31, 1936.

Articles on the work of the Geodetic Survey of Canada were prepared.

In addition to the usual notification cards and acknowledgment cards, special correspondence was employed in revising the mailing list of the Geodetic Survey of Canada.

AVAILABLE PUBLICATIONS OF THE GEODETIC SURVEY OF CANADA

Publication No.

3—Determination of Lengths of Invar Base Line Tapes from Standard Nickel Bar No. 10239.

5—Field Instructions to Geodetic Engineers in Charge of Direction Measurement on Primary Triangulation.

8—Field Instructions for Precise Levelling.

11—Geodesy.

12—Statistics of the Geodetic Survey of London, Ont. (Distributed at London.)

14—Levelling, Co-ordination of Elevations of Bench Marks in Calgary, Alberta.

15—Bench Marks along Meridians, Base Lines and Township Outlines in Saskatchewan.

16—Levelling. Precise Levelling in Nova Scotia, New Brunswick and Prince Edward Island.

17—Levelling. Precise Levelling in Quebec South of St. Lawrence River.

18—Levelling. Precise Levelling in Quebec North of St. Lawrence River.

19—Levelling. Precise Levelling in Ontario South of Parry Sound.

20—Levelling. Precise Levelling in Ontario North of Parry Sound.

21—Levelling. Precise Levelling in Manitoba.

22—Levelling. Precise Levelling in Saskatchewan.

23—Levelling. Precise Levelling in Alberta.

24—Levelling. Precise Levelling in British Columbia.

25—The Conversion of Latitudes and Departures of a Traverse to Geodetic Differences of Latitude and Longitude.

26—The Simultaneous Adjustment of Precise Traverses and Triangulation Nets.

27—The Differential Adjustment of Observations.

28—Adjustment of Precise Level Net of Canada, 1928.

29—Triangulation in Southwestern Ontario.

30—Triangulation in New Brunswick and Nova Scotia.

31—Triangulation in Quebec and New Brunswick.

32—Triangulation in New Brunswick and Prince Edward Island.

33—Triangulation in Eastern Nova Scotia, Magdalen Islands.

34—Triangulation in Quebec.

35—Triangulation Closure in the Maritime Provinces.

36—Deflection of the Plumb Line in Canada.

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37—Geodetic Operations in Canada—January 1, 1927, to December 31, 1929. Reports of the Section of Geodesy—The International Geodetic and Geophysical Union, Fourth General Conference, Stockholm, 1930.

38—Precise Levelling on Vancouver Island.

39—Altitudes in Nova Scotia and Prince Edward Island.

40—Altitudes in New Brunswick.

41—Altitudes in Quebec, South of St. Lawrence River.*

42—Altitudes in Quebec, North of St. Lawrence River.*

47—Altitudes in Saskatchewan, South of Latitude 50° 31′

48—Altitudes in Saskatchewan, North of Latitude 51° 30′.

53—Geodetic Operations in Canada—January 1, 1930, to December 31, 1932. Reports of the International Association of Geodesy. The International Geodetic and Geophysical Union, Fifth General Conference, Lisbon, 1933.

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55—Triangulation in Southeastern Ontario.

* Also French edition.

56—Recent Adjustments of the Level Net of Canada.

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60—Triangulation in Ontario and Quebec.

69—Geodetic Operations in Canada—January 1, 1933, to December 31, 1935. Reports of the International Association of Geodesy, The International Geodetic and Geophysical Union, Sixth General Conference, Edinburgh, 1936.

Where name and number (or year) are omitted, the publication is not available for distribution.

Copies of the above publications may be obtained by applying to the Director of the Geodetic Survey of Canada, Department of the Interior, Ottawa.

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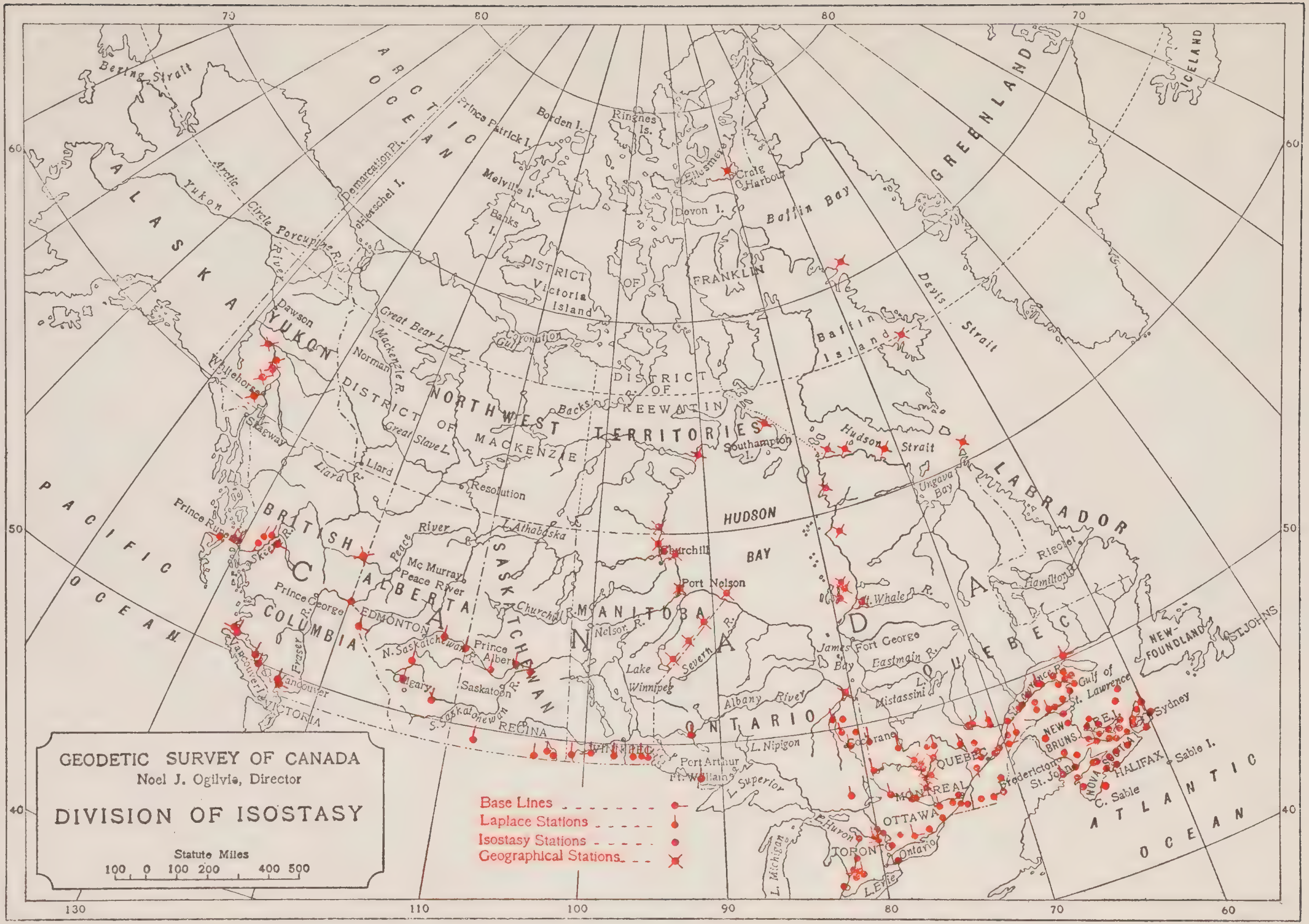
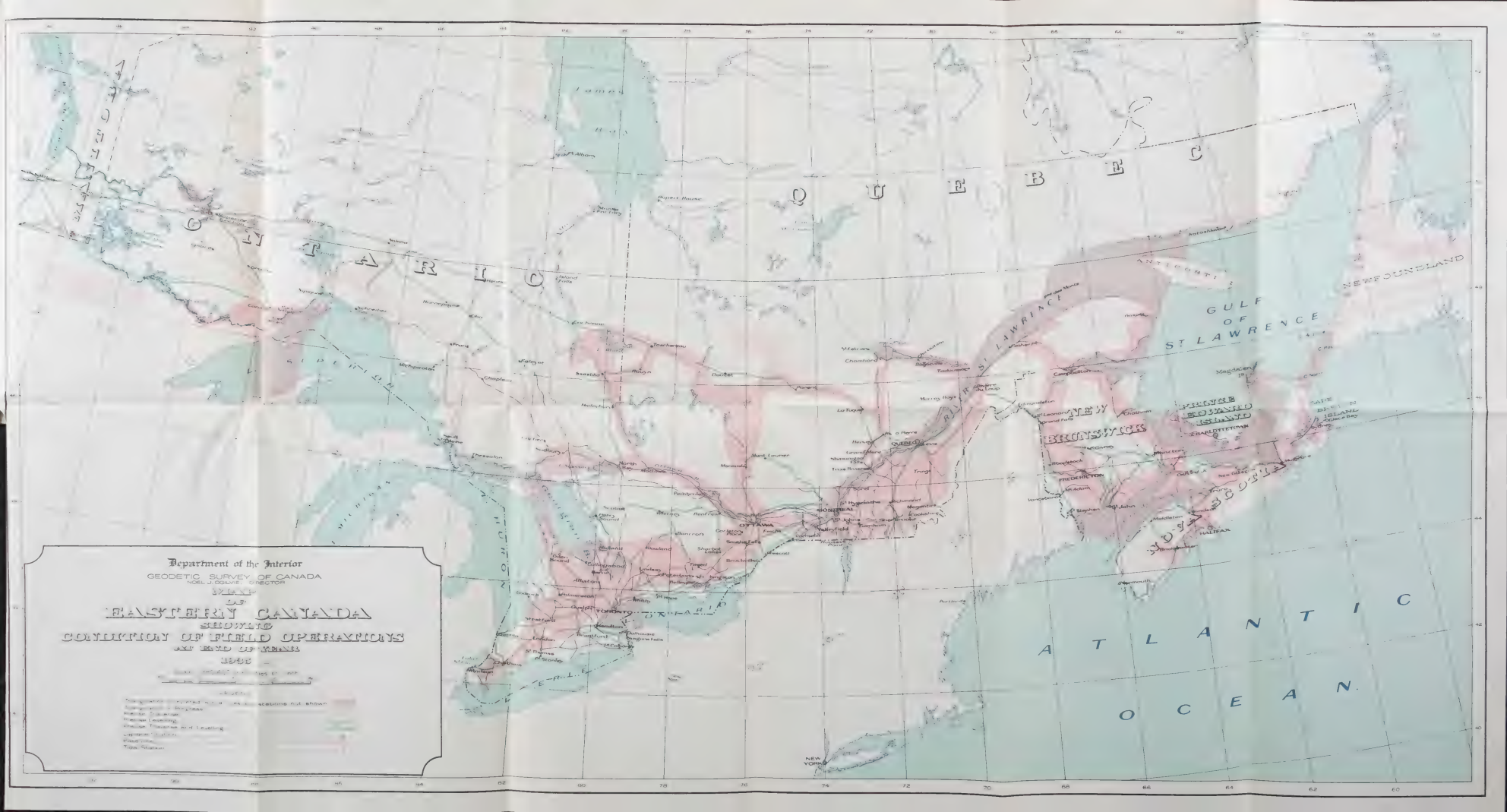

GEODETIC SURVEY OF CANADA
Noel J. Ogilvie, Director
DIVISION OF ISOSTASY
Statute Miles
100 0 100 200 400 500
Base Lines
Laplace Stations
Isostasy Stations
Geographical Stations
ARCTIC OCEAN
PACIFIC OCEAN
ATLANTIC OCEAN
ALASKA
YUKON
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
CANADA
LABRADOR
GREENLAND
ICELAND
NEW-FOUNDLAND
NEW BRUNS.
NOVA SCOTIA
P.E.I.
NORTHWEST TERRITORIES
DISTRICT OF MACKENZIE
DISTRICT OF KEEWATIN
DISTRICT OF FRANKLIN
HUDSON BAY
Hudson Strait
Davis Strait
Baffin Bay
Baffin Island
Bering Strait
Arctic Circle
Victoria Island
Banks I.
Melville I.
Prince Patrick I.
Borden I.
Ringnes Is.
Ellesmere
Craig Harbour
Devon I.
Southampton I.
Ungava Bay
Herschel I.
Demarcation Pt.
Dawson
Whitehorse
Skagway
Prince Rupert
Prince George
Vancouver
VICTORIA
EDMONTON
Calgary
Saskatoon
Prince Albert
REGINA
WINNIPEG
Churchill
Port Nelson
Port Arthur
Ft. William
Cochrane
TORONTO
OTTAWA
MONTREAL
QUEBEC
Fredericton
St. John
HALIFAX
Sydney
Sable I.
C. Sable
ST. JOHNS
Rigolet
Hamilton
Resolution
Liard
Mc Murray
Peace River
Great Bear L.
Great Slave L.
Mackenzie R.
Norman
Coronation Gulf
Backs
L. Athabaska
Lake Winnipeg
Nelson R.
Severn R.
Churchill R.
N. Saskatchewan R.
S. Saskatchewan
Fraser
Yukon
Porcupine R.
River
Liard R.
Peace River
Albany River
James Bay
Fort George
Eastmain R.
L. Mistassini
Gt. Whale R.
L. Nipigon
L. Superior
L. Michigan
L. Huron
L. Ontario
L. Erie
St. Lawrence R.
Gulf of St. Lawrence
70
80
60
50
40
130
110
100
90


Department of the Interior
GEODETIC SURVEY OF CANADA
NOEL J. DOLIVE, DIRECTOR
MAP
OF
EASTERN CANADA
SHOWING
CONDITION OF FIELD OPERATIONS
AND BOND OF YEAR
1956
ONTARIO
QUEBEC
NEW BRUNSWICK
PRINCE EDWARD ISLAND
NOVA SCOTIA
NEWFOUNDLAND
GULF OF ST LAWRENCE
ATLANTIC OCEAN
ST LAWRENCE R.
OTTAWA R.
OTTAWA
MONTREAL
TORONTO
QUEBEC
FREDERICTON
CHARLOTTETOWN
HALIFAX
NEW YORK

Department of the Interior
GEODETIC SURVEY OF CANADA
NOEL J. OGILVIE, DIRECTOR
MAP
OF
WESTERN CANADA
SHOWING
CONDITION OF FIELD OPERATIONS
AT END OF YEAR
1935
Scale 1:3,801,600 or 60 Miles to 1 inch
50 0 50 100 150
LEGEND
Triangulation Completed - Actual lines and stations not shown
Triangulation in Progress
Precise Traverse
Precise Levelling
Precise Traverse and Levelling
Laplace Station
Base Line
Tidal Station
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
UNITED STATES
PACIFIC OCEAN
HUDSON BAY
GREAT SLAVE LAKE
Lake Athabaska
L. SUPERIOR
VANCOUVER I.
QUEEN CHARLOTTE IS.
VANCOUVER
VICTORIA
EDMONTON
CALGARY
SASKATOON
REGINA
WINNIPEG
BRANDON
Prince Rupert
Prince George
Prince Albert
Medicine Hat
Lethbridge
Moose Jaw
Port Arthur
Fort William
Churchill
Port Nelson
Note:- Triangulation and traverse from Lake of the Woods to the 92nd Meridian, and from the 105th Meridian to the Pacific Coast executed by the United States Coast and Geodetic Survey as part of a co-ordinated system along the International Boundary